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Lead



UNITED STATES DEPARTMENT OF THE INTERIOR

The statistical data in this volume represents the most comprehensive, verified, domestic and international coverage for 1987 at the time the volume went to press. More recent information can be found in the monthly Lead Industry Mineral Industry Surveys obtainable from Publications Distribution, Bureau of Mines, Box 18070, Cochrans Mill Road, Pittsburgh, PA 15236.

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This publication is a chapter from the current Bureau of Mines Minerals Yearbook, comprising *Volume I, Metals and Minerals*; *Volume II, Area Reports: Domestic*; *Volume III, Area Reports: International*. The separate volumes of the Yearbook are sold by the Superintendent of Documents, Washington, D.C. 20402.

Lead

By William D. Woodbury¹

Despite the highest domestic average annual lead price in 6 years, mine production of recoverable lead declined to the lowest level since 1967 owing to technical problems. Domestic recovery of lead from recycled scrap was more than 700,000 metric tons for the first time in 8 years, as U.S. secondary plants produced at a record capacity utilization rate. Only in the years 1977-79 had that level of secondary production been exceeded. Significant restructuring and capacity increases also occurred

in the secondary sector, but one of the Nation's four remaining primary lead smelters did not operate at all during the year owing to the low domestic mine production. The Occupational Safety and Health Administration (OSHA) did not renew any expired temporary variances to its 1983 medical removal protection standard for secondary plants. OSHA estimated that 15% of the secondary industry was not in compliance at yearend.

Table 1.—Salient lead statistics

(Metric tons unless otherwise specified)

	1983	1984	1985	1986	1987
United States:					
Production:					
Domestic ores, recoverable lead content	449,295	322,677	413,955	339,793	311,298
Value	\$214,745	\$181,745	\$174,008	\$165,150	\$246,654
Primary lead (refined):					
From domestic ores and base bullion	¹ 463,940	¹ 323,989	¹ 422,650	¹ 348,217	336,471
From foreign ores and base bullion	55,227	65,409	71,353	22,071	37,139
Secondary lead (lead content)	503,501	633,374	615,695	¹ 624,769	710,217
Exports (lead content):					
Lead ore and concentrates	20,119	11,858	9,987	4,380	8,764
Lead materials excluding scrap	24,351	16,563	37,322	19,778	13,586
Imports for consumption:					
Lead in ore and concentrates	19,753	29,888	2,649	4,604	873
Lead in base bullion	53	43	760	142	10,827
Lead in pigs, bars, reclaimed scrap	¹ 180,569	166,515	134,521	143,511	192,260
Stocks, Dec. 31:					
Primary lead ²	¹ 53,405	¹ 45,126	¹ 84,502	¹ 20,400	21,608
At consumers and secondary smelters	100,771	97,077	93,130	83,824	88,586
Consumption of metal, primary and secondary	1,148,487	1,207,033	1,148,298	¹ 1,125,521	1,230,387
Price: Common lead, average, cents per pound ³	21.68	25.55	19.07	22.05	35.94
World:					
Production:					
Mine	¹ 3,357.0	¹ 3,261.9	3,427.9	² 3,375.7	³ 3,453.8
Refinery ⁴	¹ 3,264.6	¹ 3,161.1	3,369.6	² 3,229.0	³ 3,176.6
Secondary refinery	¹ 2,024.0	¹ 2,295.1	2,291.8	² 2,354.2	³ 2,453.2
Price: London Metal Exchange, pure lead, cash average, cents per pound	19.27	20.12	17.84	18.43	26.99

¹Estimated. ²Preliminary. ³Revised.

⁴Includes Bureau of Mines estimate of 42,000 metric tons of pigs and bars (lead content) of U.S. brands returned from the London Metal Exchange.

⁵American Bureau of Metal Statistics Inc. (ABMS).

⁶Metals Week. Transactions on a delivered basis.

⁷Primary metal production only. Includes secondary metal production where inseparably included in country total.

Domestic consumption of lead increased to the highest level in 8 years owing to the record-high level reported by all lead-acid storage battery manufacturers. That sector exceeded 900,000 tons for the first time, which represented a record-high share of total consumption. However, demand by industrial and traction battery manufacturers decreased slightly after 4 consecutive years of significant growth. Total automotive battery shipments, including exports, were about the same as those of 1986, resulting in a large inventory buildup of starting-lighting-ignition (SLI) batteries at yearend. All other specific uses fluctuated only slightly compared with those of 1986.

After declining slightly in the first quarter of 1987, the North American producers' mean U.S. price rose steadily, reaching 42.0 cents per pound on July 7, 1987, which held through the remainder of the year. The monthly average spread against the London Metal Exchange (LME) price declined for the first 4 months, but increased spectacularly through October, reaching a record-high 14.8 cents per pound for that month. The result for the year was a significant increase in net imports of refined metal and total net imports of contained lead in all forms, including scrap, compared with 1986 imports. The U.S. average price of 42 cents per pound for the second half of 1987 was the highest sustained level since 1980. The LME average cash price for 1987 of 27 cents per pound was the highest since 1981.

Recoverable world mine production was estimated to have increased considerably, but secondary sources provided more than 40% of the estimated demand for the fourth consecutive year. World refinery production, including secondary lead, was estimated to have increased slightly from that of 1986 but was still less than world demand. World demand increased for the 5th consecutive year and equaled the record set in 1979.

Domestic Data Coverage.—Domestic data

for lead are developed by the Bureau of Mines from five voluntary surveys of U.S. operations. Typical of these are the combined secondary producer and consumer monthly and annual surveys. Of the 274 consuming plants to which a survey request was sent, 256 responded, representing 97% of the total U.S. lead consumption shown in tables 1, 11, 12, 13, and 14. Of the 58 smelter-refineries to which a survey request was sent, 53 responded, representing 95% of the total refinery production of secondary lead recovered from scrap shown in tables 1, 8, 9, and 10. Production and consumption for the nonrespondents were estimated using reported prior year levels adjusted for general industry trends.

Legislation and Government Programs.—The Environmental Protection Agency (EPA) prohibited landfill or surface impoundments for any free liquid, solid, or sludge of any lead waste or its compounds containing 500 milligrams per liter or more of lead and required special hazardous waste disposal under the Resources Conservation and Recovery Act (RCRA). The requirement was taken directly from California State regulations, and EPA reserved the right to establish more stringent requirements. Many secondary smelters were already in compliance to avoid future liability. At yearend, the EPA was in the final process of determining the regulatory framework and standards for primary lead smelting and refining wastes under RCRA and was also considering modifying its leaching test for slag materials. The EPA was also considering a lowering of the drinking water standard for lead by up to 90%. The process effluent standards are also tied to this standard under the Clean Water Act. The U.S. Department of Transportation proposed a comprehensive overhaul of the regulations governing the transport of hazardous materials that reportedly would require shippers of lead concentrates to utilize leak-proof, sift-proof containment.

DOMESTIC PRODUCTION

MINE PRODUCTION

Domestic mine production of recoverable lead declined from that of 1986, and was the lowest since 1967, 2 years before the Viburnum Trend operations in Missouri fully came on-stream. The low output was attributed to technical problems, including lower average grades at some Missouri mines,

and only a partial year's production from some lead-producing silver mines that had shut down in 1986 and did not come back on-stream until midyear in 1987. Eight Missouri mines, of which only seven were in operation all year, together with nine lead-producing precious metals and/or zinc and copper mines in Colorado, Idaho, and Montana, accounted for nearly all of the U.S.

mined lead output in 1987. Byproduct lead was recovered from mining in four other States during the year, accounting for less than 1,000 tons of recoverable metal. Domestic lead-producing mines operated at only 47% of capacity during the year, and the top 11 mines shown in table 6 produced more than 99% of the total.

The Doe Run Co. of St. Louis, MO, operated two mine and mill complexes involving five mines in southeastern Missouri on the Viburnum Trend. The Buick Mine, the Nation's largest producer, which had been closed since May 1986, was opened early in the year. The Brushy Creek unit did not operate in 1987. According to Homestake Mining Co.'s annual report, Doe Run milled 3.68 million tons of ore averaging 5.8% lead, which resulted in 256,000 tons of lead concentrates for Doe Run's integrated Herculaneum, MO, smelter-refinery. Homestake's share of Doe Run production was 42.5% with the balance accruing to Fluor Corp., whose St. Joe Minerals Div. was the operator. At yearend, Doe Run had 68.1 million tons of ore reserves grading 5.1% lead, according to Homestake. Approximately 65% of Doe Run's holdings are under Federal lease for which the Bureau of Land Management is paid a minimum royalty of 5% of the gross value of concentrates produced.

The Magmont Mine, equally owned by Cominco American Incorporated as operator and Dresser Industries Inc., was the second largest lead-producing mine in 1987, and its output also represented the second largest company output of mined lead. Cominco's share of Magmont's concentrates was sold to ASARCO Incorporated, and Dresser's share was tolled by Asarco at Glover, MO. According to Cominco Ltd. of Canada's annual report, Magmont milled slightly more than 1 million tons of ore averaging 7.1% lead, which produced 89,000 tons of lead concentrate grading 77.0% lead contained. This was a significant decline from 1986 owing to a 1.5% decrease in the average ore grade hoisted. At yearend, Magmont had 4.26 million tons of ore reserves grading 6.4% lead, according to Cominco. Cominco announced that shipments from its Red Dog Mine in Alaska would commence in 1990. The 54-mile road from the mine to the port on the Chukchi Sea was scheduled for completion in February 1988. At full production, the zinc-lead-silver open pit mine would be the world's largest base metal operation, producing 64,000 tons of lead and 314,000 tons of zinc per year.

Red Dog's published ore reserves, including inferred, were 85 million tons grading 5.0% lead and 17.1% zinc.

Asarco operated two mine and mill complexes in the Viburnum Trend, but the refurbished Sweetwater Mine did not come on-stream until late in December. The Sweetwater Mine was the Nation's highest rated capacity lead mine at 91,000 tons per year. According to Asarco's annual report, the West Fork Mine produced at only 55% of its 50,000 tons per year of lead in concentrates capacity in 1987 owing to technical problems. As the Sweetwater and West Fork Mines work up to planned capacities, Asarco's Glover, MO, smelter-refinery will be able to operate solely with integrated, high-grade clean concentrates. Any excess resulting from Glover's supply contract with Cominco and Dresser will fulfill some of the needs of Asarco's East Helena, MT, plant. Therefore, Asarco reduced its interest in MIM Holdings Ltd. of Australia, a major lead and zinc producer, from 34.9% to 19% in the third quarter of 1987. At yearend, Asarco had lead ore reserves in Missouri of 23.1 million tons grading 4.84% at Sweetwater and 9.8 million tons grading 7.07% at West Fork.

Hecla Mining Co. reopened the Lucky Friday Mine in Idaho, normally a large lead producer, in midyear after being shut down for over a year owing to unfavorable silver prices. Production of lead was curtailed owing to startup of a new mining system in a recently developed area with reportedly lower average in situ lead grades. Pegasus Gold Inc. opened a new open pit gold-silver-zinc-lead mine in June. Known as Montana Tunnels, its anticipated capacity for lead is 5,000 tons per year.

SMELTER AND REFINERY PRODUCTION

Primary.—According to Homestake's annual report, the Doe Run smelter-refinery at Herculaneum, MO, the Nation's largest, produced just under one-half of the total domestic reported primary metal output in 1987. The plant produced about 18,000 tons more than in 1986, and operated at about 88% of its rated capacity. The Doe Run smelter-refinery at Boss, MO, did not operate during 1987, but was kept on care and maintenance. The sinter machine, however, was used while the one at the Herculaneum smelter was being rebuilt.

Asarco operated a smelter-refinery at Glover, MO, a smelter at East Helena, MT, and a refinery at Omaha, NE, that also

processed secondary materials as well as the bullion from East Helena. The Glover facility contributed 33% of the Nation's 1987 primary lead production, according to Asarco's annual report, and operated well above its rated capacity for the third consecutive year owing to higher grades of raw materials feed and minimal downtime. The three U.S. primary refineries operated at only 63% of capacity in 1987, the same as in 1986, whereas the smelters were at 73% of capacity.

Secondary.—The U.S. secondary industry at yearend consisted of 20 companies, which operated 27 plants with refined metal capacities ranging from 5,000 to 80,000 tons per year and were responsible for 95% of the reported secondary production. There were also 28 small producers who operated 29 plants with annual capacities averaging 1,200 tons, which produced mainly specialty alloys for such uses as solders, brass or bronze ingots, and bearing metals. Early in the year, two plants in California and Florida with a combined annual capacity of 16,000 tons were closed. At yearend, industry installed capacity was 855,000 tons, a

55,000-ton increase from yearend 1986. Secondary capacity utilization for 1987 was a record high 83%.

Two significant mergers occurred during the year, which represented a major restructuring of integrated battery manufacturers and lead producers. Pacific Dunlop of Australia, owner of Pacific Chloride Inc., a U.S. integrated producer-manufacturer, acquired ownership of GNB Inc., also integrated, to further enhance GNB's position as the No. 2 U.S. secondary lead producer. Exide Corp., a large battery manufacturer, acquired General Battery Corp., a large integrated producer-manufacturer, thereby becoming the Nation's largest integrated battery manufacturer. Pacific Dunlop-GNB Inc. and RSR Corp., the Nation's largest secondary lead producer, each operated three smelter-refineries at yearend. Exide-General Corp., Refined Metals Corp., and Schuylkill Metals Corp. each operated two plants. These 12 plants, together with the Sanders Lead Co. smelter-refinery at Troy, AL, the world's largest secondary lead plant, accounted for nearly three-quarters of U.S. secondary lead production in 1987.

CONSUMPTION AND USES

Total domestic consumption of lead increased by 105,000 tons in 1987 compared with that of 1986, of which 100,000 tons was in the lead-acid storage battery sector, exceeding the previous record by 74,300 tons in 1978 for battery manufacturers. The battery share of total consumption also achieved a record high 78%. Most other uses increased or decreased only slightly compared with 1986 uses. Lead in all casting metals exhibited a strong comeback owing to a generally strong economy in 1987 reflected by the transportation industry, which included trucks, buses, and automobiles, as well as heavy equipment and lighter in-plant equipment. Lead for type metal, cans, tubes, and other shipping containers continued a 10-year decline as did leaded gasoline additives. Lead in power and communication cables increased for the fourth consecutive year, doubling its use in 1983 owing to the recently developed lead foil-plastic laminates supplanting other plastics.

According to statistics from the Battery Council International and Bureau of the Census, total 1987 shipments of replacement and original equipment automotive batteries, including exports, were 50,000 units greater than those shipped in 1986, less than a 0.1% increase. Export shipments increased by 667,800 units to 2,747,300 units, but domestic shipments decreased by 618,300 units, just under 1%. Total shipments of automotive batteries were 75.71 million units in 1987 compared with 75.66 million units in 1986, representing less than 500 tons of increased lead usage. There was a slight decline in lead use for industrial and traction batteries in 1987, and therefore a huge surplus of lead in the form of SLI battery inventories and materials in process (battery grids and oxides) was on hand at yearend from the excessive metal consumed. Lead demand by the industrial and traction battery sector in 1987 was estimated to be 158,700 tons.

STOCKS

Metal stocks at domestic primary refineries increased marginally, but raw material feedstocks decreased significantly, which reflected the low U.S. mine output and negligible imports for consumption of lead concentrates during 1987. Refined pig lead stocks held by secondary producers and consumers at yearend increased nominally after 3 consecutive years of decreasing owing to the high level of imports. Total yearend stocks of contained lead in all forms, excluding scrap, held by all domestic producers and consumers, was about the

same as those at yearend 1986.

Stocks of lead and antimonial lead metal in the market economy countries reporting to the International Lead and Zinc Study Group (ILZSG) were approximately 412,000 tons at yearend, slightly more than 7% of 1987 total world demand, and 12,000 tons higher than stocks at yearend 1986.² Stocks in LME warehouses were only 16,000 tons at yearend, a decrease of 22,000 tons from those at yearend 1986, and the lowest level since 1978, when they were also at 16,000 tons.

PRICES

According to Metals Week, the North American producers U.S. price range, which had been listed at 28 to 29 cents per pound in mid-December 1986, was lowered uniformly to 27 cents in mid-January 1987 and then to 26 cents on February 3, the low level of the year. The price rose gradually from early April to 42 cents per pound on July 7, which was sustained for the remainder of the year. The spread against the LME, which was 6.9 cents per pound in January, declined during February, March, and April to a low of 2.7 cents per pound for that month. The spread then rose in each month through October, reaching a record-high 15.1 cents for the last week of that month. This resulted in almost 40% of the pig lead imports for the whole year entering in September through November. The sustained mean and quoted price of 42 cents per pound was the highest level in the U.S. since 1980 except for August of 1981 (43.9 cents). The year average for 1980 was 42.5 cents per pound on a reported transactions value-weighted basis, which is no longer available.

On the LME, the monthly average cash price fluctuated about 1 cent per pound during the first quarter of the year after dropping 2.5 cents per pound in January compared with December 1986. It rose gradually from mid-April through the third week of May, achieving the highest

monthly average of the year at 31.4 cents per pound. May's average price was the highest since October 1981 (32.5 cents). This resulted in the LME physical stock level's dropping to its lowest level (10,300 tons on May 8) since February 1980, when it was 8,900 tons at monthend. Weekly average prices fluctuated between 31.4 cents per pound for the week ending July 10 and 26.8 cents per pound for the week ending October 2, 1987. The monthly average prices for the 7-month period ranged from 27.3 cents for October to 30.1 cents for July. The yearend price on December 25 was 30.3 cents per pound compared with the average of June through December of about 29 cents. The average price for the year was 27 cents per pound.

The domestic prices for lead oxides were based on the selling price plus conversion charges for pig lead in a given period. Premium adjustments were also made by individual producers to reflect differences in manufacturing techniques, freight considerations, quality and packaging requirements, or other factors. According to American Metal Market, the quoted premiums for litharge ranged from about 4.25 to 6.5 cents per pound for bags or drums in truckload lots and 10.5 to 11 cents per pound for 97% red lead. The premium for Bulk Battery (leady litharge) was about 2 cents per pound.

FOREIGN TRADE

Owing to the low domestic mine and primary metal production in the face of healthy domestic demand and prices, exports of contained lead in all forms were down from 1986 and represented the second lowest total since 1976. Raw material and metal exports were negligible, and scrap exports were down slightly. Canada, Brazil, and Taiwan received about one-half of the scrap exported, almost all of which was thought to be spent lead-acid batteries. The lead content of exported scrap was estimated to be 60%. The United States had 159,000 tons of net imports for consumption of lead in all forms, excluding chemicals, pigments, and oxides, a 69,000-ton net increase from 1986. Almost 90% of the contained lead imported was refined pig lead, three-quarters of which came from Canada and Mexico, the traditional suppliers.

Imports of chrome yellow used for highway markings and litharge, which together represented more than 80% of the lead chemicals and compounds imported for consumption, increased significantly in 1987. Total imports of all these categories remain-

ed about the same as those in 1986. Mexico accounted for almost all of the U.S. imports of litharge and red lead, and Canada supplied more than one-half of the remaining total of chemicals and compounds, including three-quarters of the chrome yellow. The Federal Republic of Germany, Hungary, and the Netherlands accounted for most of the balance of chrome yellow. The Federal Republic of Germany, Japan, and Mexico supplied virtually all of the lead acetate; the United Kingdom supplied all of the lead arsenate; China, Hong Kong and Belgium supplied 90% of the lead nitrate; and the Federal Republic of Germany and the Netherlands supplied almost 80% of the basic white lead carbonate imports. Canada, the Federal Republic of Germany, the Netherlands, and the United Kingdom accounted for 90% of the imports of all other salts, pigments, and compounds. Canada and Mexico accounted for 86% of the total U.S. imports of all lead chemicals and compounds, including oxides on a tonnage basis.

Table 2.—U.S. import duties for lead materials, January 1, 1987

(Lead content)

Item	TSUS No.	Most favored nation (MFN)	Least developed developing countries	Non-MFN
Ore	602.10	0.75 cent per pound	Free ¹ or current MFN rate	1.5 cents per pound.
Lead bullion	624.02	3.5% ad valorem	do	10.5% ad valorem.
Other unwrought	624.03	3.5% ad valorem ²	Current MFN rate only	10.0% ad valorem.
Waste and scrap	624.04	2.3% ad valorem	Free ¹ or current MFN rate.	11.5% ad valorem.

¹Free if eligible under General System of Preferences.²Established at 3.0% ad valorem (retroactive to July 1, 1983) but not to be less than 1.0625 cents per pound, on Oct. 30, 1984, by the Omnibus Trade Act.

WORLD REVIEW

According to the ILZSG statistics, consumption of soft lead and antimonial lead in the market economy countries was 4.24 million tons, compared with 4.11 million tons in 1986, 4.03 million tons in 1985, and 3.97 million tons in 1984.³ Estimated world consumption of lead in all forms during 1987 was 5.73 million tons, compared with 5.65 million tons in 1986 (revised) and equaling the previous alltime high established in 1979. The comparable figures for 1985 and 1984 were 5.56 and 5.45 million tons, respectively (revised). Estimated world total refinery production, including that from re-

cycled scrap, increased by nearly 50,000 tons compared with that of 1986, reflecting the increased performance of the U.S. secondary industry during 1987. The significant decrease in primary metal production in Canada because of labor-management difficulties was more than offset by the return of primary metal output in Australia to 1984 and 1985 levels. The result was the nominal increase in the total reported ILZSG metal stocks level.

Seven new lead-producing mines came on-stream in 1987, which together with a major reopening in the United States and several

expansions elsewhere in capacities, including China, resulted in a net capacity increase of 45,000 tons after accounting for closures and permanent reductions in output at some mines owing to declining grades or other technical reasons. The estimated yearend world capacity of 4.24 million tons per year represented a gain of 200,000 tons since 1984, the low point in world mine capacity of the decade. With the addition of a major new lead smelter in Italy and the closure of Tunisia's only smelter-refinery, estimated world lead-smelting capacity rose by 60,000 tons to 4.40 million tons per year, compared with 4.55 million tons of refinery capacity at yearend.

Australia.—The significant increase in 1987 lead mine production was primarily attributed to the return to a full year's production at Broken Hill, New South Wales, of Australia Mining & Smelting Ltd. (AM&S), and North Broken Hill Holdings Ltd. (NBHH). These mines had work stoppages due to lengthy midyear management-labor difficulties in 1986. The new Hellyer Mine in Tasmania of Aberfoyle Ltd., 46% owned by Cominco Ltd. of Canada, came on-stream in midyear, treating its ore at a converted tin mill about 40 kilometers from the site. BHP Minerals Ltd. (58%) Billiton Australia's (42%) new joint-venture mine at West Kimberly, Western Australia, began operations, and ore was stockpiled for the commissioning of the new mill scheduled for 1988. The new ore body is the first "Mississippi Valley Type" deposit to be developed in Australia, and the planned ore throughput was 320,000 tons per year. The combined capacities estimated for the two new mines was 19,500 tons per year of lead in concentrates and 68,700 tons of zinc.

Production increased slightly at Nicron Resources Ltd.'s open pit mine near Darwin in the Northern Territory, which had opened in late 1985. Accelerated underground development begun late in 1986 continued through the first half of 1987. Reserves were estimated at about 1 million tons, averaging 7.5% lead and 12.9% zinc. Production at Mount Isa Mines, Queensland, and the NBHH mines on the west coast of Tasmania and at Elura, New South Wales, remained level with those of 1986. Production declined slightly at the Woodlawn and CSA (AM&S) Mines in New South Wales. The open pit portion of the Woodlawn Mine, which was completed in May, was purchased by Denehurst Ltd. from AM&S in July. Mining continued toward an eventual

target of 500,000 tons per year of ore from reserves of 2.5 million tons grading 4.8% lead and 11.8% zinc. Production at Broken Hill Associated Smelters Pty. Ltd. plant at Port Pirie, South Australia, the country's only producer of primary refined lead, increased significantly with return to normal operation following the midyear 1986 labor-management disputes. Australian lead mining capacity at yearend was estimated to be 556,000 tons per year, about 20,000 tons greater than for all of Asia, including China, but about 100,000 tons less than for the United States. Australia produced more than 150,000 tons more than the United States in 1987.

Underground development continued at Mount Isa Mines Ltd.'s Hilton silver-lead-zinc deposit 20 kilometers north of Mount Isa, Queensland. Trial stoping began in June at the rate of 2,000 tons per week. It was anticipated that a commercial mining operation based on the integration of Hilton ore into the Mount Isa Mine's declining output will start in the late 1980's, keeping MIM's output level. Proven reserves at Hilton were 11 million tons of ore grading 6.7% lead and 9.1% zinc. Probable reserves were estimated to be an additional 38 million tons of 6.4% lead and 9.3% zinc with considerable further potential in the immediate area. The Pancontinental Mining Ltd. (51%) Outokumpu Oy of Finland (49%) joint venture completed exploratory shaft sinking at their Lady Loretta, Queensland, project begun in 1986 and continued with exploratory development, test mining, drilling, and bulk sampling. The Pancontinental-Outokumpu joint venture agreed to purchase BHP Minerals Ltd.'s interest in the Thalanga base-and-precious-metals deposit near Charters Towers in northern Queensland. It also obtained an option to buy the remaining 11% interest held by Electrolytic Zinc Co. of Australia, which would give it full ownership. The joint venture had acquired its initial 50% interest in June from Peñarroya (Australia) Pty. Ltd. The prospect has ore reserves of 7.8 million tons grading 2.7% lead, 8.7% zinc, 2.2% copper, 71 grams of silver, and 0.47 gram of gold per ton. Mining leases have been secured, and an operating pilot plant is on-site. A feasibility study was to extend through 1988 for consideration of a possible open pit and underground operation.

Austria.—The nation's only primary smelter-refinery at Gailitz, owned by Bleiburger Bergwerks-Union AG, expanded ca-

capacity by 7,000 tons per year to 24,000 tons and replaced the conventional refinery with a matching 24,000-ton-per-year electrolytic plant.

Brazil.—Cia. Paulista de Metais acquired the lead-producing Boquira Mine and Plumbum Mine in Bahia and Paraná, respectively, from Peñarroya at a cost of \$18 million and was expected to raise its total lead production by 8,000 tons in 1988 to 40,000 tons per year. The new group will be called Sociedad Paulista de Metais. The Morro Agudo Mine owned by Mineração Morro Agudo S.A., a joint venture of Cia. Mineira Metais and Paraibuna de Metais of Paracatu, Minas Gerais, opened in December with a capacity of 6,500 tons per year of lead. Cia. Paulista de Metais was expanding its primary smelter in Pánelas to match the capacity of the mines acquired from Peñarroya.

Canada.—Mine production of lead increased significantly in 1987 owing to accelerated ore production at Pine Point Mines Ltd.'s (50% owned by Cominco Ltd.) mine in the Northwest Territories prior to its midyear closing. Milling was to continue through mid-1988 from the stockpiled ore with concentrate shipments to continue through 1990 to Cominco's smelter at Trail, British Columbia. Construction of the modern QSL bath-type autogenous replacement plant continued on schedule during the year at Trail, and production was expected to start in mid-1989. The metallurgical complex at Trail was shut down for 17 weeks because of a strike. Cominco's Sullivan Mine at Kimberly, British Columbia, the other feeder for Trail, was also shut down. As a result, Canadian production of refined metal declined by more than 30,000 tons compared with 1986 production.

Curragh Resources Corp.'s large open pit Faro Mine in the Yukon Territory reached planned capacity in 1987, and development work was started at the nearby Grum and Vangorda deposits, which were planned to be gradually phased in as production from Faro declines. Giant Resources Ltd., the natural resource subsidiary of Ariadne Australia Ltd., purchased a 46% interest in the Faro Mine, equal to Curragh's share. Boliden AB of Sweden owns the remaining 8% share. East-West Minerals NL of Australia acquired the Caribou property of Anaconda Minera's Co. in New Brunswick and continued development work toward a summer 1988 startup. The open pit mine will reportedly produce about 120,000 tons per year of a bulk lead-zinc concentrate containing 15,000 tons of lead in 1989. Metallgesellschaft

AG of the Federal Republic of Germany incorporated its foreign mining interests in Canada during the year as Metall Mining Corp. Ltd. Some of its assets included interests in Cominco, MIM, and Teck Corp., which are major lead and zinc producers. Canadian lead mining capacity at yearend was estimated to be about 360,000 tons per year.

Honduras.—American Pacific Holdings purchased the El Mochito Mine from AMAX Inc. in October and resumed production in November after being shut down since the end of April.

Italy.—Nuova Samim (SAMIM) brought its new primary bath smelter, a Soviet technology Kivcet design, on-stream at Porto Vesme, Sardinia, with a lead capacity of 84,000 tons per year. The plant replaced an older ISF plant that had 14,000 tons per year less capacity. Società Italiana Minière (SIM) expanded an existing mine and brought on a new mine and mill at Montepioni, Sardinia, with a combined additional lead capacity of 13,000 tons per year. SIM was split from SAMIM to primarily control mining activity in the lead-zinc sector.

Japan.—Three lead-zinc mines representing 12,000 tons of lead per year, or about 30% of the nation's primary lead capacity, were shut down during the year in Miyagi, Fukui, and Akita.

Spain.—Boliden AB of Sweden acquired Andaluza de Piratas S.A. (APIRSA) from the Banco Central. APIRSA was the operator of the Aznacollar open pit mine in Sevilla, which has a capacity of 25,000 tons of lead per year, plus 40,000 tons of zinc, 12,000 tons of copper, and 60,000 tons of silver. Reportedly, it had become unprofitable in recent years. Two new lead-zinc-silver deposits in Cuidad Real and León were under study by Minas de Almadén y Arrayanes S.A. and Peñarroya S.A. with Empresa Nacional Adaro de Investigación Mineras S.A. (Enadimsa), respectively, reportedly to come on-stream in 1990 with an additional 28,000 tons of lead capacity.

Tunisia.—At Megrine, the only primary lead smelter-refinery, with a capacity of 30,000 tons per year, was closed in January.

Yugoslavia.—A new underground mine at Toranica operated by SOUR Zletovo-Sasa came on-stream with an initial lead capacity of 10,000 tons per year. Full capacity of 17,000 tons per year was scheduled to be reached in 1992. The Suplja Stijena Mine at Gradac, Montenegro, with an estimated lead capacity of 6,000 tons per year and one of 13 mines operated by SOUR Trepcas, was closed.

TECHNOLOGY

A prototype, customer-side-of-the-meter, load-leveling system utilizing lead-acid batteries was established at Johnson Controls Inc.'s Milwaukee, WI, battery manufacturing plant. The new system, the first operating commercial-scale project of the concept in the United States, was to undergo extensive testing and modifications during 1988, including trials with zinc bromine and hydrogen-nickel oxide batteries. The "Advanced Load Management System" operates at 600 volts and has a capacity of 600 kilowatt hours, estimated to be sufficient to operate a typical home for 30 days or 300 homes for 2 hours taking advantage of time-of-use electricity rates. The prototype system was installed with 300 lead-acid, deep-discharge, stationary batteries modified for load management requirements and inte-

grated with advanced digital controls and computerized analysis equipment. The system uses load profile simulations and energy management concepts as a means to develop the technology to anticipate and respond to peak demands for electricity.⁴

A comprehensive coverage of lead-related investigations and an extensive review of current world literature on the extraction and uses of lead and its products, including batteries, were published in quarterly issues of Leadscon, Lead Development Association, London, United Kingdom.

¹Physical Scientist, Branch of Nonferrous Metals.

²International Lead and Zinc Study Group (London). Lead and Zinc Statistics. ILZSG Mon. Bull., v. 28, No. 10, Oct. 1988, pp. 17-18; v. 29, No. 11, Nov. 1988, pp. 17-18.

³Work cited in footnote 2.

⁴Advanced Battery Technology. V. 24, No. 1, Jan. 1988, pp. 4-5.

Table 3.—Mine production of recoverable lead in the United States, by State

(Metric tons)

State	1983	1984	1985	1986	1987
Alaska	W				
Arizona	234	W	581	W	
California	W	W			
Colorado	W	W	W	W	W
Idaho	25,893	W	33,707	9,951	W
Illinois	W	W	W	W	W
Missouri	409,280	278,329	371,008	319,900	W
Montana	1,163	W	846	W	W
Nevada	14	W	(¹)		
New Mexico	258		W	10	W
New York	1,299	W	W	W	W
Oregon	W				
Tennessee		W	W		W
Utah		W			
Washington					
Total	449,295	322,677	413,965	339,793	311,298

W Withheld to avoid disclosing company proprietary data; included in "Total."

¹Less than 1/2 unit.

Table 4.—Mine production of recoverable lead in the United States, by month

(Metric tons)

Month	1986	1987
January	40,392	24,194
February	36,277	23,910
March	38,216	27,859
April	33,984	23,628
May	25,038	26,957
June	23,763	26,302
July	25,168	29,022
August	23,420	24,114
September	24,186	28,178
October	24,301	28,447
November	20,800	23,195
December	24,248	25,492
Total	339,793	311,298

Table 5.—Production of lead and zinc, in terms of recoverable metal, in the United States in 1987, by State

State	Lead ore			Zinc ore			Lead-zinc ore		
	Gross weight (dry basis)	Lead	Zinc	Gross weight (dry basis)	Lead	Zinc	Gross weight (dry basis)	Lead	Zinc
Colorado	---	---	---	---	---	---	W	W	W
Idaho	---	---	---	---	---	---	---	---	---
Illinois	---	---	---	---	---	---	---	---	---
Kentucky	---	---	---	---	---	---	---	---	---
Missouri	W	W	W	109	---	10	W	W	W
Montana	---	---	---	---	---	---	---	---	---
New Mexico	---	---	---	---	---	---	---	---	---
New York	---	---	---	W	W	W	---	---	---
Tennessee	---	---	---	W	W	W	---	---	---
Total	W	W	W	4,792,226	W	153,384	1,405,635	W	W
Percent of total lead or zinc	XX	W	W	XX	W	71	XX	W	W
Copper-lead, copper-zinc, copper-lead-zinc ores				All other sources ^{1 2}			Total		
	Gross weight (dry basis)	Lead	Zinc	Gross weight (dry basis)	Lead	Zinc	Gross weight (dry basis)	Lead	Zinc
Colorado	---	---	---	W	W	W	W	W	W
Idaho	---	---	---	W	W	W	W	W	W
Illinois	---	---	---	W	W	W	W	W	W
Kentucky	---	---	---	---	---	---	---	---	---
Missouri	1,020,071	32,404	604	---	---	---	109	---	10
Montana	---	---	---	W	W	W	W	W	34,956
New Mexico	---	---	---	---	---	---	---	---	---
New York	---	---	---	W	W	---	W	W	W
Tennessee	W	---	W	---	---	---	5,291,664	W	115,699
Total	W	32,404	W	W	13,911	15,984	13,225,706	311,298	216,981
Percent of total lead or zinc	XX	10	W	XX	4	7	XX	100	100

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

¹Includes lead and zinc recovered from copper, gold, gold-silver, and silver ores, from fluorspar and from mill tailings.

²Excludes tonnages of fluorspar in Illinois from which lead and zinc were recovered as byproducts.

Table 6.—Twenty-five leading lead-producing mines in the United States in 1987, in order of output

Rank	Mine	County and State	Operator	Source of lead
1	Buick	Iron, MO	The Doe Run Co	Lead-zinc ore
2	Magmont	do	do	Lead ore
3	Viburnum No. 29	Washington, MO	The Doe Run Co	Do
4	Casteel	Iron, MO	do	Copper-lead ore
5	West Fork	Reynolds, MO	ASARCO Incorporated	Lead ore
6	Fletcher	do	The Doe Run Co	Do
7	Viburnum No. 28	Iron, MO	do	Do
8	Leadville Unit	Lake, CO	ASARCO Incorporated	Lead-zinc ore
9	Sunnyside	San Juan, CO	Sunnyside Gold Corp	Gold ore
10	Lucky Friday	Shoshone, ID	Hecla Mining Co	Silver ore
11	Montana Tunnels	Jefferson, MT	Montana Tunnels Mining Inc	Gold ore
12	Balmat	St. Lawrence, NY	Zinc Corporation of America	Zinc ore
13	Sweetwater	Reynolds, MO	ASARCO Incorporated	Lead ore
14	Black Pine	Granite, MT	Black Pine Mining Co	Silver ore
15	Rosiclare	Hardin and Pope, IL	Ozark-Mahoning Co	Fluorspar
16	Pierrepont	St. Lawrence, NY	Zinc Corporation of America	Zinc ore
17	St. Cloud	Sierra, NM	St. Cloud Mining Co	Gold-silver ore
18	Clayton	Custer, ID	Clayton Silver Mines	Silver ore
19	New Market	Jefferson, TN	ASARCO Incorporated	Zinc ore
20	Young Mill	do	do	Do
21	Immel	Knox, TN	do	Do
22	Coy	Jefferson, TN	do	Do
23	Silver King	Granite, MT	Stryker's Gold	Gold ore
24	Pinos Altos	Grant, NM	Cyprus Minerals Co	Copper ore
25	Cross	Boulder, CO	Hendricks Mining Co. Inc	Gold ore

Table 7.—Refined lead produced at primary refineries in the United States, by source material¹

(Metric tons unless otherwise specified)

Source material	1983 ²	1984 ²	1985 ²	1986 ²	1987
Refined lead					
From primary sources:					
Domestic ores and base bullion	463,940	323,989	422,650	348,217	336,471
Foreign ores and base bullion	55,227	65,409	71,353	22,071	37,139
Total	519,167	389,398	494,003	370,288	373,610
Calculated value of primary refined lead ²	thousands \$248,142	\$219,340	\$207,689	\$180,004	\$296,026

¹Revised.²Total refined lead: American Bureau of Metal Statistics Inc. (ABMS). Domestic and foreign ores: Bureau of Mines calculations.³Value based on average quoted price.**Table 8.—Stocks and consumption of new and old lead scrap in the United States, by type of scrap**

(Metric tons, gross weight)

Type of scrap	Stocks, Jan. 1	Receipts	Consumption			Stocks Dec. 31
			New scrap	Old scrap	Total	
1986						
Smelters, refiners, others:						
Soft lead ¹	1,476	27,729		28,017	28,017	1,188
Hard lead	694	8,572		9,052	9,052	214
Cable lead	620	2,243		2,398	2,398	465
Battery-lead plates	26,811	689,723		695,032	695,032	21,502
Mixed common babbitt	298	1,241		1,406	1,406	133
Solder and tinny lead	2,856	22,718		23,179	23,179	2,395
Type metals	510	2,305		2,634	2,634	181
Drosses and residues	9,026	62,370	66,024		66,024	5,372
Total	42,291	\$816,901	66,024	\$761,718	\$827,742	31,450
1987						
Smelters, refiners, others:						
Soft lead ¹	1,188	31,910		31,243	31,243	1,855
Hard lead	214	5,249		4,896	4,896	567
Cable lead	465	2,054		1,665	1,665	854
Battery-lead plates	21,502	799,442		792,360	792,360	28,584
Mixed common babbitt	133	1,593		1,631	1,631	95
Solder and tinny lead	2,395	21,908		22,527	22,527	1,776
Type metals	181	1,902		1,911	1,911	172
Drosses and residues	5,372	68,407	68,586		68,586	5,193
Total	31,450	932,465	68,586	856,233	924,819	39,096

¹Revised.²Includes remelt lead from cable sheathing plus other soft lead scrap processing.**Table 9.—Secondary metal recovered¹ from lead and tin scrap in the United States**

(Metric tons)

	Lead	Tin	Antimony	Other	Total
1986					
Refined pig lead	269,526	—	—	—	269,526
Remelt lead	29,020	—	—	—	29,020
Total	289,546	—	—	—	289,546
Refined pig tin ²	—	1,140	—	—	1,140
Lead and tin alloys:					
Antimonial lead	291,943	891	9,950	621	303,405
Lead-base babbitt	1,091	66	108	3	1,268
Solder	24,059	3,676	181	15	27,931
Type metals	1,369	197	210	2	1,778
Other alloys including cable lead	2,796	17	2	—	2,815
Total	321,258	4,847	10,451	641	337,197

See footnotes at end of table.

**Table 9.—Secondary metal recovered¹ from lead and tin scrap in the United States
—Continued**

	(Metric tons)				
	Lead	Tin	Antimony	Other	Total
1986—Continued					
Tin content of chemical products	W				W
Grand total	⁶ 610,804	⁵ 5,987	10,451	641	⁶ 627,883
1987					
Refined pig lead	334,844				334,844
Remelt lead	14,065				14,065
Total	348,909				348,909
Refined pig tin ²		1,159			1,159
Lead and tin alloys					
Antimonial lead	319,474	623	11,205	756	332,058
Lead-base babbitt	1,132	77	129	2	1,340
Solder	23,152	3,765	171	⁽³⁾	27,088
Type metals	919	66	130	4	1,119
Other alloys including cable lead	2,229	30	19		2,278
Total	346,906	4,561	11,654	762	363,883
Tin content of chemical products	W				W
Grand total	695,815	5,720	11,654	762	713,951

¹Revised. W Withheld to avoid disclosing company proprietary data.

²Most of the figures herein represent actual reported recovery of metal from scrap.

³Includes remelt tin.

⁴Included with "Antimony" to avoid disclosing company proprietary data.

**Table 10.—Lead recovered from scrap processed in the United States, by kind of scrap
and form of recovery**

	(Metric tons)	
	1986 ¹	1987
KIND OF SCRAP		
New scrap:		
Lead-base	45,854	49,035
Copper-base	3,639	3,478
Tin-base	5	38
Total	49,498	52,551
Old scrap:		
Battery lead plates	504,629	588,705
All other lead base	60,284	57,947
Copper-base	10,358	11,014
Tin-base		
Total	575,271	657,666
Grand total	624,769	710,217
FORM OF RECOVERY		
As soft lead	289,546	348,909
In antimonial lead	291,943	319,474
In other lead alloys	29,278	27,304
In copper-base alloys	13,997	14,492
In tin-base alloys	5	38
Total	624,769	710,217
Value ²	thousands	
	\$303,712	\$562,734

¹Revised.

²Value based on average quoted price of common lead.

Table 11.—U.S. consumption of lead, by product
(Metric tons)

SIC code	Product	1986	1987
	Metal products:		
3482	Ammunition: Shot and bullets	44,382	46,835
	Bearing metals:		
35	Machinery except electrical	581	393
36	Electrical and electronic equipment	268	173
371	Motor vehicles and equipment	3,787	4,362
37	Other transportation equipment	889	334
	Total	5,525	5,262
3351	Brass and bronze: Billets and ingots	9,057	9,868
36	Cable covering: Power and communication	17,061	20,140
15	Calking lead: Building construction	1,833	1,893
	Casting metals:		
36	Electrical machinery and equipment	1,198	970
371	Motor vehicles and equipment	1,357	(¹)
37	Other transportation and equipment	6,790	14,299
3443	Nuclear radiation shielding	923	1,285
	Total	10,268	16,554
	Pipes, traps, other extruded products:		
15	Building construction	11,900	11,532
3443	Storage tanks, process vessels, etc.	642	(²)
	Total	12,542	11,532
	Sheet lead:		
15	Building construction	12,572	13,746
3443	Storage tanks, process vessels, etc.	2,038	(³)
3693	Medical radiation shielding	2,665	3,654
	Total	17,275	17,400
	Solder:		
15	Building construction	4,513	3,946
341	Metal cans and shipping containers	2,048	1,027
367	Electronic components and accessories	4,333	4,654
36	Other electrical machinery and equipment	2,196	2,658
371	Motor vehicles and equipment	8,212	7,473
	Total	21,302	19,758
	Storage batteries:		
3691	Storage battery grids, post, etc.	488,932	529,362
3691	Storage battery oxides	364,878	424,236
	Total	853,810	953,598
371	Terne metal: Motor vehicles and equipment	3,497	2,286
27	Type metal: Printing and allied industries	306	(⁴)
34	Other metal products ⁵	3,678	4,844
	Total	⁶ 1,000,536	1,109,970
	Other oxides:		
285	Paints	14,400	W
32	Glass and ceramic products	40,781	W
28	Other pigments and chemicals	14,346	W
	Total	69,527	68,094
2911	Gasoline additives	28,541	(⁶)
	Miscellaneous uses	26,917	52,323
	Grand total	⁷ 1,125,521	1,230,387

¹Revised. W Withheld to avoid disclosing company proprietary data, included with "Other oxides: Total."

²Included with "Other transportation and equipment" to avoid disclosing company proprietary data.

³Included with "Building construction" to avoid disclosing company proprietary data.

⁴Included with "Building construction" to avoid disclosing company proprietary data.

⁵Included with "Other metal products" to avoid disclosing company proprietary data.

⁶Includes lead consumed in foil, collapsible tubes, annealing, galvanizing, plating, and fishing weights.

⁷Included with "Miscellaneous uses" to avoid disclosing company proprietary data.

Table 12.—U.S. consumption of lead, by month¹

(Metric tons)			
Month	1986 ²	1987	
January	100,805	96,511	
February	89,000	91,069	
March	82,969	103,012	
April	94,685	100,969	
May	89,785	101,368	
June	87,715	103,460	
July	73,831	97,364	
August	98,875	103,165	
September	105,902	108,514	
October	110,464	119,087	
November	94,860	105,799	
December	96,630	100,061	
Total ³	1,125,521	1,230,387	

¹Revised.²Monthly totals include monthly reported consumption plus the prorated monthly distribution for companies that report on an annual basis only.³Includes lead that went directly from scrap to fabricated products and lead contained in leaded zinc oxide.Table 13.—U.S. consumption of lead in 1987, by State¹

(Metric tons)					
State	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
California	53,675	39,110	9,641	—	102,426
Connecticut	3,767	3,237	—	16	7,020
Florida	10,291	7,852	1,070	—	19,213
Georgia	23,841	8,767	2,516	—	35,124
Illinois	27,330	41,054	2,722	866	71,972
Indiana	221,045	33,720	11,921	606	267,292
Kansas	14,912	6,895	8,123	—	30,230
Kentucky	10,112	13,137	1,280	—	24,529
Massachusetts	785	133	46	54	1,018
Michigan	14,110	12,733	494	—	27,337
Missouri	10,599	19,798	—	—	30,397
New Jersey	45,885	203	1,669	236	47,991
New York	16,716	5,918	11,399	—	34,033
Ohio	15,027	15,104	4,110	269	34,450
Pennsylvania	163,999	33,079	30,922	1,451	171,451
Tennessee	1,365	10,140	2,306	—	13,811
Alabama and Mississippi	12,749	4,212	2,895	2,513	22,369
Arkansas and Oklahoma	1,365	359	74	—	1,798
Colorado and Nebraska	293	32	187	543	1,055
District of Columbia and Maryland	92	—	—	—	92
Hawaii and Oregon	4,039	8,595	938	—	13,572
Idaho, Montana, and Washington	12,114	970	—	—	13,084
Iowa and Minnesota	20,118	23,064	7,922	—	51,124
Louisiana and Texas	77,239	19,323	5,422	—	101,984
New Hampshire, Maine, Vermont, Delaware	13,370	14,917	—	19	28,306
North Carolina and South Carolina	37,332	24,209	7,809	—	69,350
Rhode Island and Wisconsin	3,650	296	32	43	4,021
Utah, Nevada, Arizona	1,370	153	1,333	—	2,856
Virginia and West Virginia	43	382	2,057	—	2,482
Total	759,231	347,412	117,188	6,556	1,230,387

¹Includes lead that went directly from scrap to fabricated products and lead contained in leaded zinc oxide.Table 14.—U.S. consumption of lead in 1987, by class of product¹

(Metric tons)					
Product	Soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
Metal products	64,108	59,375	26,333	6,556	156,372
Storage batteries	581,376	287,024	85,198	—	953,598
Other oxides	68,079	15	—	—	68,094
Gasoline additives	W	—	—	—	W
Miscellaneous	45,668	998	5,657	—	52,323
Total	759,231	347,412	117,188	6,556	1,230,387

W Withheld to avoid disclosing company proprietary data, included with "Miscellaneous."

¹Includes lead that went directly from scrap to fabricated products and lead contained in leaded zinc oxide.

Table 15.—Production and shipments of lead pigments¹ and oxides in the United States

(Metric tons unless otherwise specified)

Product	1986				1987			
	Production		Shipments		Production		Shipments	
	Gross weight	Lead content	Quantity	Value ²	Gross weight	Lead content	Quantity	Value ²
White lead, dry	470	376	587	\$794,640	W	W	W	W
Litharge and red lead	72,810	67,507	70,836	55,556,500	79,252	73,414	80,568	\$72,292,620
Lead oxide	376,382	357,564	NA	NA	436,688	414,855	NA	NA
Total	449,662	425,447	NA	NA	515,940	488,269	NA	NA

NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Excludes basic lead sulfate, withheld to avoid disclosing company proprietary data.²At plant, exclusive of container.

Table 16.—U.S. imports for consumption of lead pigments and compounds, by kind

Kind	1986		1987	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
White lead	540	\$598	644	\$939
Red lead	534	257	703	626
Litharge	11,270	4,810	14,263	10,290
Chrome yellow	1,934	3,061	3,354	5,573
Other lead pigments	¹ 674	1,551	445	1,286
Other lead compounds	2,181	2,655	1,894	2,431
Total	² 17,133	12,932	21,213	21,145

¹ Revised.

Source: Bureau of the Census.

Table 17.—Stocks of lead at consumers and secondary smelters in the United States, December 31

(Metric tons, lead content)

Year	Refined soft lead	Lead in antimonial lead	Lead in alloys	Lead in copper-base scrap	Total
1983	57,881	37,159	5,085	646	100,771
1984	53,802	37,015	5,326	934	97,077
1985	50,475	36,374	5,770	511	93,130
1986	47,589	30,442	5,524	269	83,824
1987	55,278	27,959	5,185	164	88,586

Table 18.—Average monthly and annual quoted prices of lead¹

(Cents per pound)

Month	1986		1987	
	U.S. producer	London Metal Exchange	North American primary producer mean	London Metal Exchange
January	18.35	16.69	27.88	21.02
February	17.79	16.64	26.04	20.86
March	18.20	16.64	26.00	22.07
April	18.73	16.74	27.84	25.17
May	19.38	17.06	34.95	31.40
June	22.07	18.96	36.93	28.51
July	21.94	17.21	41.67	30.06
August	22.42	17.77	42.00	29.88
September	23.43	18.45	42.00	29.31
October	² 25.55	19.69	42.00	27.25
November	² 28.01	21.45	42.00	29.10
December	² 28.68	23.48	42.00	29.86
Average	22.05	18.43	35.94	26.9 ^a

¹Metals Week. Quotations for the United States on a nationwide, delivered basis. LME cash average.²U.S. producer price through Sept. 1986. North American Mean (NAM) quotation (weighted) from October.

Table 19.—U.S. exports of lead, by country

Country	1986		1987	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Ore and concentrates (lead content):				
Australia	182	\$68	187	\$100
Belgium-Luxembourg	5	5	36	16
Canada	693	208	793	240
Germany, Federal Republic of	308	237	-	-
India	14	14	8	5
Japan	-	-	1,800	958
Mexico	3,146	942	5,325	1,597
Mozambique	-	-	90	83
Taiwan	24	12	466	291
Venezuela	-	-	18	10
Other	^a 8	^a 5	40	33
Total	4,380	1,491	8,764	3,333
Drosses and residues including flue dust (lead content):				
Austria	-	-	40	46
Belgium-Luxembourg	218	1,504	54	620
Canada	6,088	1,794	2,642	874
India	31	9	-	-
France	40	296	18	200
Germany, Federal Republic of	-	-	35	18
Mexico	11	4	11	4
Thailand	73	12	151	54
United Kingdom	707	1,253	519	773
Total	7,177	4,872	3,470	2,589
Unwrought lead and lead alloys (lead content):				
Australia	37	55	73	78
Belgium-Luxembourg	415	2,681	55	207
Brazil	1,993	392	-	-
Canada	3,225	2,058	526	706
Chile	164	173	76	98
China	84	94	-	-
Dominican Republic	148	90	111	122
Egypt	33	64	-	-
Germany, Federal Republic of	842	1,058	2	4
Haiti	38	25	-	-
Honduras	2	3	20	19
India	243	54	-	-
Indonesia	1	2	17	17
Israel	51	23	15	12
Italy	22	37	7	13
Japan	14	51	69	80
Korea, Republic of	466	407	1,267	1,166
Liberia	20	10	18	16

See footnotes at end of table.

Table 19.—U.S. exports of lead, by country —Continued

Country	1986		1987	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Unwrought lead and lead alloys (lead content) — Continued				
Malaysia	35	\$234		
Mexico	1,194	569	347	\$694
Netherlands	19	264		
Panama			17	39
Philippines			25	59
Saudi Arabia	5	12		
Singapore	1	3	83	117
South Africa, Republic of	3	15	16	86
Sudan	79	54		
Taiwan	1,917	862	959	737
Trinidad			451	63
United Kingdom	80	84	146	138
Venezuela	2	7	4	15
Other	57	201	47	136
Total	11,190	9,582	4,351	4,922
Wrought lead and lead alloys (lead content):				
Argentina			11	13
Australia	3	28	18	41
Barbados	8	58		
Belgium-Luxembourg	2	75	1	6
Brazil	16	24	2	17
Canada	211	163	4,374	3,413
Dominican Republic	9	8	34	46
France	20	29	62	115
Germany, Federal Republic of	8	23	4	64
Honduras	7	18	6	18
Hong Kong	5	14	1	29
Ireland	18	25	6	8
Israel	9	49	16	73
Italy	(1)	2	6	7
Jamaica	27	39	77	98
Japan	111	286	48	49
Korea, Republic of	15	75	2	6
Mexico	834	3,065	1,005	2,643
Netherlands	1	14	18	19
Panama	11	23	8	14
Philippines	2	4	(1)	2
Saudi Arabia	(1)	5	1	12
Singapore	20	35	3	25
Spain	22	34		
Taiwan	6	36	8	36
United Kingdom	8	17	8	21
Venezuela	15	68	13	21
Other	23	198	33	227
Total	1,411	4,415	5,765	7,023
Grand total	24,158	20,360	22,350	17,867
Scrap (gross weight):				
Austria			183	40
Belgium-Luxembourg	29	99	659	110
Brazil	16,137	4,008	7,289	2,183
Canada	2,640	762	9,337	2,903
Colombia			451	87
Germany, Federal Republic of	770	333	1,469	431
India	1,423	813	617	184
Ireland	644	193		
Italy	20	17	41	9
Japan	625	409	82	196
Korea, Republic of	5,570	1,521	4,507	1,032
Mexico	2,529	430	5,667	1,360
Netherlands	485	314	125	56
Pakistan			263	69
Portugal	99	28		
South Africa, Republic of			204	45
Spain	14	2	1,268	225
Taiwan	21,688	2,914	8,953	1,669
Thailand	179	51		
United Arab Emirates			800	205
United Kingdom	3,025	2,075	5,618	3,832
Venezuela	3,051	918	5,260	1,025
Other	70	34	30	9
Total	58,998	14,921	52,823	15,670

(1) Revised.

(2) Less than 1/2 unit.

Source: Bureau of the Census.

Table 20.—U.S. exports of lead¹

Year	Blocks, pigs, anodes, etc.				Wrought lead and lead alloys				Scrap (gross weight)		Drosses, etc.	
	Unwrought ²		Unwrought alloys		Sheets, plates, rods, other forms		Foil, powder, flakes		Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)				
1985	23,468	\$14,050	1,912	\$2,150	1,870	\$4,635	94	142	59,949	\$12,963	9,978	\$5,732
1986	8,869	6,036	2,321	3,546	1,290	4,183	211	232	58,998	14,921	7,177	4,872
1987	3,367	3,181	984	1,741	5,686	6,910	79	113	52,823	15,670	3,470	2,589

¹Lead content, unless otherwise specified.²Includes bullion.

Source: Bureau of the Census.

Table 21.—U.S. imports¹ of lead, by country

(Lead content)

Country	1985		1986		1987	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Ore and concentrates: ²						
Australia	12,260	\$2,407	11,497	\$2,246	1,724	\$456
Canada	5,195	1,246	62,900	7,325	201,165	50,683
Chile	765	106	3,106	914	3,231	985
China	—	—	—	—	3,568	2,203
Honduras	1,568	757	—	—	—	—
Mexico	4,321	1,356	827	287	1,070	628
Peru	15,176	4,017	8,417	1,174	19,098	10,309
South Africa, Republic of	3,381	1,316	—	—	—	—
Total	³ 42,665	11,205	86,747	11,946	229,856	65,264
Base bullion:						
Belgium-Luxembourg	—	—	—	—	1,414	955
France	713	375	121	67	1,699	1,136
Germany, Federal Republic of	—	—	—	—	350	258
Italy	—	—	—	—	1,250	904
Japan	—	—	—	—	1,800	1,165
Mexico	48	29	21	47	881	278
Netherlands	—	—	—	—	1,749	1,276
Spain	—	—	—	—	1,200	886
United Kingdom	—	—	—	—	461	284
Other	—	—	—	—	83	97
Total	³ 760	398	142	114	10,827	7,239
Pigs and bars:						
Australia	3,627	1,758	—	—	63	37
Belgium-Luxembourg	15	13	⁴ 1	⁴ 1	4,950	3,259
Canada	90,056	33,783	105,281	44,080	92,643	61,384
China	—	—	77	31	574	357
France	20	9	—	—	3,193	2,102
Germany, Federal Republic of	542	3,080	496	658	8,824	5,755
Italy	—	—	—	—	1,800	1,232
Japan	—	—	1	2	906	704
Macao	—	—	—	—	403	298
Mexico	33,771	13,271	29,532	11,617	42,635	28,457
Morocco	—	—	—	—	1,500	1,001
Mozambique	—	—	—	—	87	66
Netherlands	10	23	—	—	6,317	3,939
Panama	—	—	47	19	—	—
Peru	5,150	1,770	1,053	449	350	189
Poland	—	—	—	—	2,500	1,535
Spain	—	—	—	—	5,999	3,887
Sweden	—	—	2,773	1,055	9,086	5,887
Switzerland	—	—	20	11	201	141
U.S.S.R.	—	—	262	96	—	—
United Kingdom	337	807	679	1,153	4,039	3,180
Yugoslavia	—	—	—	—	1,020	634
Zambia	—	—	—	—	903	612
Other	—	—	⁴ 83	⁴ 83	83	146
Total	³ 133,529	54,514	140,221	59,172	188,076	124,842

See footnotes at end of table.

Table 21.—U.S. imports¹ of lead, by country —Continued

(Lead content)

Country	1985		1986		1987	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Reclaimed scrap, including drosses: ²						
Canada	1,118	\$454	1,444	\$383	3,062	\$1,600
Hong Kong					48	31
Japan					323	185
Malaysia					38	23
Mexico	2,035	720	1,831	1,060	3,034	1,230
Panama					44	23
Philippines					17	10
Other	15	34	15	28	21	26
Total	3,168	1,208	3,290	1,471	6,587	3,128
Grand total	180,122	67,325	230,400	72,703	435,346	200,473

¹Revised.²General imports include lead imported for immediate consumption plus material entering the country under bond.³Also includes other lead-bearing materials containing greater than 5 troy ounces of gold per short ton or greater than 100 troy ounces of total precious metals per short ton.⁴Data do not add to total shown because of independent rounding.⁵Less than 1/2 unit.⁶Revised to zero.⁷Also includes other lead-bearing materials containing greater than 10% by weight of copper, lead, or zinc (any one).

Source: Bureau of the Census.

Table 22.—U.S. imports for consumption of lead, by country

Country	1985		1986		1987	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Ore and concentrates (lead content) ¹						
Australia			1,725	\$380		
Canada					696	\$231
Chile	765	\$196	2,652	677		
Honduras	1,568	757				
Mexico	317	116	827	287	177	77
Total ²	2,649	979	4,604	1,344	873	308
Base bullion (lead content)						
Belgium-Luxembourg					1,414	955
Canada	713	375	121	67		
France					1,699	1,136
Germany, Federal Republic of					350	258
Italy					1,250	904
Japan					1,800	1,165
Mexico	48	23	21	47	881	278
Netherlands					1,749	1,276
Spain					1,290	886
United Kingdom					461	284
Other					83	97
Total ²	760	398	142	114	10,827	7,239
Pigs and bars (lead content)						
Australia	91	443			63	37
Belgium-Luxembourg	15	14			4,950	3,299
Canada	90,056	33,795	105,281	44,080	92,643	61,384
China			77	31	574	357
France	20	9			3,193	2,192
Germany, Federal Republic of	542	3,080	496	658	7,325	4,682
India	1,361	664				
Italy					1,800	1,232
Japan			1	2	906	704
Mexico					403	298
Morocco	33,771	13,271	29,532	11,617	42,635	28,437
Mozambique					1,506	1,001
Netherlands	10	23			87	66
					6,317	3,939

See footnotes at end of table.

Table 22.—U.S. imports for consumption of lead, by country —Continued

Country	1985		1986		1987	
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
Pigs and bars (lead content) —Continued						
Peru	5,150	\$1,770	1,053	\$449	350	\$189
Poland	—	—	—	—	2,500	1,535
Spain	—	—	—	—	5,999	3,887
Sweden	—	—	2,773	1,055	9,086	5,887
Switzerland	—	—	21	11	201	141
United Kingdom	337	807	679	1,153	4,039	3,180
U.S.S.R.	—	—	262	96	—	—
Yugoslavia	—	—	—	—	1,020	634
Other	—	—	746	720	82	146
Total	131,353	53,864	140,221	59,172	185,673	123,157
Reclaimed scrap, etc. (lead content): ³						
Canada	1,118	454	1,444	383	3,062	1,600
Hong Kong	—	—	—	—	48	31
Japan	—	—	—	—	323	185
Malaysia	—	—	—	—	38	23
Mexico	2,035	720	1,531	1,060	3,034	1,230
Panama	—	—	—	—	44	23
Philippines	—	—	—	—	17	10
Other	15	38	15	28	21	26
Total	3,168	1,212	3,290	1,471	6,587	3,128
Grand total	137,930	56,453	148,257	62,101	203,960	133,832
Sheets, pipe, shot, other forms (gross weight):						
Belgium-Luxembourg	44	57	454	418	18	38
Canada	419	627	299	293	352	414
Germany, Federal Republic of	149	576	132	422	256	827
Italy	1	13	18	40	55	110
Japan	18	197	20	241	128	2,338
Mexico	164	147	43	22	180	121
Peru	121	61	100	45	622	360
Spain	36	11	13	11	118	140
United Kingdom	1,027	809	228	255	1,047	895
Other	72	719	737	778	17	58
Total	1,981	2,517	1,344	1,825	2,793	5,301

²Revised.³Also includes other lead-bearing materials containing greater than 5 troy ounces of gold per short ton or greater than 100 troy ounces of total precious metals per short ton.²Data may not add to totals shown because of independent rounding.³Also includes other lead-bearing materials containing greater than 10% by weight of copper, lead, or zinc (any one).

Source: Bureau of the Census.

Table 23.—U.S. imports for consumption of lead¹

Year	Blocks, pigs, anodes, etc.				Wrought lead and lead alloys (gross weight)				Scrap		Drosses, etc.	
	Unwrought ²		Unwrought alloys		Sheets, plates, rods, other forms		Foil, powder, flakes		Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)
	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)	Quantity (metric tons)	Value (thou- sands)				
1985	119,633	\$44,952	12,480	\$9,310	1,684	\$2,211	297	\$306	2,550	\$1,068	618	\$144
1986	124,061	50,279	16,392	9,007	1,165	1,526	179	299	2,269	1,306	1,021	165
1987	182,852	119,444	13,648	10,952	2,483	2,768	310	2,533	6,088	2,805	499	323

¹Lead content, unless otherwise specified.²Includes bullion.

Source: Bureau of the Census.

Table 24.—U.S. imports for consumption of miscellaneous products containing lead¹

Year	Gross weight (metric tons)	Lead content (metric tons)	Value (thousands)
1984	2,671	1,963	\$17,299
1985	3,377	1,453	22,124
1986	1,016	517	3,810
1987	970	515	4,185

¹Babbitt metal, solder, white metal, and other lead-containing combinations.

Source: Bureau of the Census.

Table 25.—Lead: World mine production of lead in concentrates, by country¹

(Thousand metric tons)

Country ²	1983	1984	1985	1986 ³	1987 ⁴
Algeria ⁵	3.0	4.0	3.8	3.6	3.6
Argentina	31.7	28.5	28.6	28.9	28.8
Australia	480.6	440.6	498.0	447.7	476.0
Austria	4.3	4.2	7.5	5.9	4.5
Bolivia	11.8	7.4	6.2	3.1	8.2
Brazil	18.8	16.7	19.2	⁵ 19.5	14.9
Bulgaria ⁵	95.0	95.0	95.0	95.0	97.0
Burma	23.1	21.9	21.9	18.2	³ 27.1
Canada	251.5	264.3	268.3	349.3	413.4
Chile	1.7	4.3	2.5	1.5	9
China	⁵ 160.0	⁵ 180.0	⁵ 200.0	227.0	³ 252.0
Colombia	.2	.1	.1	.2	³ .2
Congo (Brazzaville)	⁵ 4.0	1.7	1.5	⁵ 1.4	1.4
Czechoslovakia	3.2	3.1	⁵ 3.2	⁵ 3.2	3.2
Ecuador	.2	.2	⁵ .2	⁵ .2	.2
Finland	2.1	2.6	2.4	2.0	³ 2.2
France	1.5	2.3	2.5	2.5	³ 2.2
Germany, Federal Republic of	23.5	21.0	20.5	16.7	³ 18.8
Greece ⁵	20.0	22.0	19.4	20.0	20.0
Greenland	21.6	17.7	17.8	16.2	³ 20.5
Honduras	19.3	20.5	21.2	12.6	20.0
Hungary ⁵	.7	.7	.7	.4	.5
India	⁵ 25.7	24.8	27.1	37.6	39.0
Iran	⁵ 18.5	19.9	21.6	30.0	21.6
Ireland	33.6	37.2	34.6	36.4	³ 33.8
Italy	23.6	20.8	15.6	11.1	20.0
Japan	46.9	48.7	50.0	40.3	³ 28.3
Korea, North ⁵	75.0	110.0	110.0	110.0	110.0
Korea, Republic of	12.2	10.8	9.7	11.9	12.0
Mexico	184.3	202.6	197.9	207.0	200.0
Morocco	97.9	100.7	106.8	76.2	³ 75.7
Namibia	38.5	33.3	34.6	37.5	37.0
Nigeria ⁵	.3	⁵ .3	.8	.1	.1
Norway	⁵ 4.3	4.0	3.6	⁵ 3.5	3.0
Peru	207.4	193.7	201.5	194.4	204.0
Poland	47.0	52.1	51.3	50.3	50.2
Romania ⁵	30.0	30.0	28.0	28.0	28.0
South Africa, Republic of	⁵ 7.5	94.8	98.4	97.8	³ 93.6
Spain	⁵ 82.0	96.6	85.6	⁵ 82.1	84.0
Sweden	⁵ 85.8	⁵ 82.8	80.6	⁵ 90.0	90.0
Thailand	21.0	16.7	19.7	26.3	³ 23.5
Tunisia	4.6	4.1	2.5	1.9	2.0
Turkey ⁵	⁵ 9.0	⁵ 10.0	⁵ 10.0	⁵ 10.0	10.0
U.S.S.R. ⁵	435.0	440.0	440.0	440.0	440.0
United Kingdom	3.8	2.4	4.0	3.6	3.6
United States	465.6	334.5	424.4	353.1	318.7
Yugoslavia	114.0	113.6	115.1	116.9	98.0
Zambia	25.9	18.1	15.0	14.9	12.0
Total ⁴	⁵ 3,357.0	⁵ 3,261.9	3,427.9	3,375.7	3,453.8

⁵Estimated. ³Preliminary. ¹Revised.

¹Table includes data available through June 24, 1988.

²In addition to the countries listed, Uganda may produce lead, but available information is inadequate to make reliable estimates of output levels.

³Reported figure.

⁴Data may not add to totals shown because of independent rounding.

Table 26.—Lead: World smelter production, by country¹

(Thousand metric tons)

Country	1983	1984	1985	1986 ^b	1987 ^c
Argentina:					
Primary (refined)	15.2	16.3	15.1	24.3	20.0
Secondary (refined)	16.0	15.0	13.6	15.0	15.0
Total	31.2	31.3	28.7	39.3	35.0
Australia:					
Primary:					
Bullion for export	182.6	179.5	183.2	188.4	² 197.2
Refined	196.3	198.8	200.1	156.2	² 201.3
Secondary (refined) ^d	27.0	21.5	15.6	¹ 14.8	15.6
Total ^e	405.9	399.8	398.9	¹ 359.4	414.1
Austria:					
Primary	4.2	1.7	1.9	1.5	1.5
Secondary	12.9	16.5	15.6	15.0	14.5
Total	17.1	18.2	17.5	16.5	16.0
Belgium:					
Primary ^{e, 3}	54.4	71.5	² 67.0	70.0	70.0
Secondary ⁴	30.0	30.0	8.3	⁴ 10.0	10.0
Total	84.4	101.5	75.3	⁴ 80.0	80.0
Brazil:					
Primary (refined)	20.6	26.0	29.8	32.7	² 28.8
Secondary (refined)	28.9	¹ 45.7	51.8	38.9	² 45.4
Total	49.5	¹ 71.7	81.6	71.6	² 74.2
Bulgaria: ⁶					
Primary	112.0	112.0	112.0	110.0	110.0
Secondary ⁴	4.0	4.0	4.0	5.0	5.0
Total	116.0	116.0	116.0	115.0	115.0
Burma: Primary (refined)	7.6	7.0	9.6	5.4	² 4.0
Canada:					
Primary (refined)	¹ 178.0	173.0	173.2	169.9	² 139.5
Secondary (refined)	63.9	79.0	68.4	87.7	² 86.3
Total	¹ 241.9	252.0	241.6	257.6	² 225.8
China: ⁶					
Primary (refined)	165.0	165.0	¹ 170.0	¹ 200.0	200.0
Secondary (refined)	30.0	30.0	¹ 40.0	¹ 40.0	40.0
Total	195.0	195.0	¹ 210.0	² 240.0	240.0
Colombia: Secondary (refined) ⁸	3.0	3.0	3.0	4.0	4.0
Cyprus: Secondary (refined) ⁸	2.5	2.5	2.0	2.0	2.0
Czechoslovakia: Secondary (refined)	21.0	21.1	21.4	23.6	20.0
Denmark: Secondary (refined)	10.0	13.0	4.5	.6	—
Finland: Secondary (refined)	6.0	4.5	4.4	1.2	1.2
France:					
Primary (refined)	¹ 115.0	117.9	133.6	132.0	² 115.6
Secondary	13.6	13.5	12.2	⁴ 12.5	12.3
Total	¹ 128.6	131.4	145.8	¹ ⁴ 144.5	127.9
German Democratic Republic: Secondary ⁸	20.0	22.0	20.0	20.0	18.0
Germany, Federal Republic of:					
Primary	116.2	102.3	109.7	111.1	² 113.6
Secondary	236.3	254.9	246.6	255.5	² 229.4
Total	352.5	357.2	356.3	366.6	² 343.0
Greece: Primary (refined)	—	—	15.0	16.0	16.0
Guatemala: Secondary (refined)	.1	.1	.1	.1	² .1
Hungary: Secondary (refined) ⁶	.1	.1	.1	.1	.1
India:					
Primary (refined)	15.0	15.2	15.6	19.9	² 20.4
Secondary (refined)	6.6	⁴ 10.0	⁴ 10.0	11.3	² 12.0
Total	21.6	⁴ 25.2	⁴ 25.6	31.2	² 32.4

See footnotes at end of table.

Table 26.—Lead: World smelter production, by country¹—Continued

(Thousand metric tons)

Country	1983	1984	1985	1986 ²	1987 ³
Ireland: Secondary (refined)	8.0	9.1	9.0	10.2	10.4
Italy:					
Primary (refined)	37.0	37.6	29.5	29.3	66.0
Secondary (refined)	89.4	102.9	96.7	101.7	94.0
Total	126.4	140.5	126.2	131.0	160.0
Jamaica: Secondary (refined) ⁴	1.0	1.0	1.0	1.0	1.0
Japan:					
Primary	198.9	207.9	218.3	220.4	² 227.2
Secondary (refined)	118.3	129.2	133.3	128.7	² 119.5
Total	317.2	337.1	351.6	349.1	² 346.7
Korea, North: Primary (refined) ⁵	60.0	95.0	95.0	95.0	95.0
Korea, Republic of: ⁶					
Primary (refined)	⁷ 7.6	⁷ 11.4	⁷ 11.0	⁷ 32.1	32.4
Secondary (refined)	⁷ 10.2	⁷ 8.9	⁷ 9.2	⁷ 27.5	27.6
Total	17.8	20.3	⁷ 20.2	⁷ 59.6	60.0
Malaysia: Secondary (refined)	5.3	10.3	14.6	13.8	14.0
Mexico:					
Primary	166.8	174.8	203.0	197.3	200.0
Secondary (refined) ⁸	31.0	30.0	31.0	⁷ 33.0	33.0
Total ⁹	197.8	204.8	234.0	⁷ 230.3	233.0
Morocco:					
Primary (refined)	55.2	46.1	59.5	⁶ 60.0	62.5
Secondary (refined) ⁹	2.0	2.0	2.0	2.0	2.0
Total ⁹	57.2	48.1	61.5	62.0	64.5
Namibia: Primary (refined)	35.4	28.9	38.5	40.0	40.0
Netherlands:					
Primary	2.0	(⁵)	(⁵)	(⁵)	—
Secondary (refined) ¹⁰	² 23.6	25.0	25.0	25.0	30.0
Total ⁹	² 25.6	² 25.0	² 25.0	² 25.0	30.0
New Zealand: Secondary (refined) ⁶	6.0	6.0	6.0	6.0	6.0
Nigeria: Secondary	.4	.6	.8	⁶ 1.0	1.0
Peru:					
Primary (refined)	67.7	70.2	81.8	66.4	66.4
Secondary (refined) ¹¹	5.0	5.0	5.0	5.0	5.0
Total ⁹	72.7	75.2	86.8	⁷ 71.4	71.4
Philippines: Secondary (refined)	6.0	4.0	7.0	7.0	7.0
Poland: ⁶					
Primary (refined)	56.5	58.4	61.1	⁷ 63.3	60.0
Secondary (refined) ¹²	24.5	25.0	26.2	25.0	25.0
Total	81.0	83.4	87.3	88.3	85.0
Portugal: Secondary (refined)	6.0	6.0	7.0	⁶ 6.5	6.5
Romania: ⁶					
Primary (refined)	40.0	35.9	38.6	36.0	35.0
Secondary (refined)	9.3	10.0	10.0	⁷ 15.5	10.0
Total	49.3	45.9	48.6	51.5	45.0
South Africa, Republic of: Secondary (refined)	23.6	30.8	32.8	40.5	41.0
Spain:					
Primary (refined) ¹³	107.8	110.1	112.8	88.0	77.0
Secondary (refined)	36.0	49.9	43.3	42.0	40.0
Total	143.8	160.0	156.1	130.0	117.0
Sweden:					
Primary	60.8	65.6	58.8	⁶ 65.9	65.0
Secondary	15.2	27.7	25.9	29.8	30.0
Total	76.0	93.3	84.7	⁷ 94.8	95.0

See footnotes at end of table.

Table 26.—Lead: World smelter production, by country¹—Continued

(Thousand metric tons)

Country	1983	1984	1985	1986 ²	1987 ³
Switzerland: Secondary (refined)	2.0	2.0	2.0	2.5	2.4
Taiwan: Secondary (refined) ⁴	38.0	44.3	44.4	⁵ 53.5	54.0
Thailand: Secondary (refined)	3.2	6.2	7.5	9.1	10.0
Trinidad and Tobago: Secondary (refined) ⁶	2.0	2.0	2.0	2.0	1.8
Tunisia:					
Primary (refined)	10.4	8.4	2.0	2.2	2.2
Secondary (refined) ⁷	.5	.5	.5	.5	.5
Total ⁸	10.9	8.9	2.5	⁵ 2.7	2.7
Turkey: ⁹					
Primary (refined)	2.0				
Secondary (refined)	5.5	9.0	10.0	10.0	10.0
Total	7.5	9.0	10.0	10.0	10.0
U.S.S.R. ¹⁰					
Primary (refined)	490.0	495.0	500.0	500.0	505.0
Secondary (refined)	255.0	260.0	265.0	270.0	275.0
Total	745.0	755.0	765.0	770.0	780.0
United Kingdom:					
Primary	40.7	36.1	36.0	37.8	² 34.4
Secondary (refined) ¹¹	185.3	191.3	179.1	172.5	² 200.7
Total	226.0	227.4	215.1	210.3	² 235.1
United States:					
Primary (refined)	¹ 519.2	¹ 389.4	494.0	370.3	² 373.6
Secondary (refined)	503.5	633.4	615.7	624.8	² 710.2
Total	¹ 1,022.7	¹ 1,022.8	1,109.7	995.1	² 1,083.8
Venezuela: Secondary (refined) ¹²	15.0	17.0	18.0	16.0	17.0
Yugoslavia:					
Primary	93.1	109.8	116.7	129.9	125.0
Secondary	34.0	¹ 11.5	15.0	25.0	20.0
Total	127.1	121.3	131.7	154.9	145.0
Zambia: Primary (refined)	14.6	8.8	8.0	6.6	6.6
Grand total	¹ 5,244.5	¹ 5,422.6	5,587.9	5,541.4	5,646.7
Of which:					
Primary	³ 3,247.8	³ 3,175.6	3,401.3	3,277.0	3,311.2
Secondary	¹ 1,996.7	¹ 2,247.0	2,186.6	2,264.4	2,335.5

¹Estimated. ²Preliminary. ³Revised.

⁴Table includes data available through June 24, 1988. Figures presented represent, to the extent possible, production of unrefined lead, including bullion and impure lead derived from new and old scrap. The figures for secondary lead for a number of countries are undoubtedly high, but sufficient information is not available to separate reprocessed scrap lead from lead merely remelted. Countries for which this is the case have been footnoted (see footnote 4). For those countries from which unrefined lead production is not reported, but where available information suggests that there is little if any import or export of bullion for refining and refined lead output has been reported, it is so noted parenthetically because it is believed that the difference between smelter output and refined output is negligible.

⁵Reported figure.

⁶Data not reported, derived from reported primary refined lead output minus imports of lead bullion plus exports of lead bullion and checked against use of lead content of domestically produced ores plus lead content of imported ores (estimated) minus lead content of exported ores (estimated).

⁷Some part of the total entered may be merely remelt, and as such probably should not be included here, but a substantial part of the total presumably was reprocessed to qualify as a secondary smelter product. Available information is inadequate to permit differentiation, and the total has been included, although it is recognized that this produces a slightly inflated figure.

⁸Revised to zero.⁹Includes a small amount of primary lead from domestic concentrate.

Table 27.—Lead: World refinery production, by country¹

(Thousand metric tons)

Country	1983	1984	1985	1986 ^b	1987 ^c
Argentina:					
Primary	15.2	16.3	15.1	24.3	20.0
Secondary	16.0	15.0	13.6	15.0	15.0
Total	31.2	31.3	28.7	39.3	35.0
Australia:					
Primary	196.3	198.8	200.1	156.2	² 201.3
Secondary ^a	27.0	21.5	15.6	¹ 14.8	15.6
Total ^a	223.3	220.3	215.7	¹ 171.0	216.9
Austria:					
Primary	12.0	10.0	10.0	6.0	5.0
Secondary	11.5	16.2	15.5	19.0	15.0
Total	23.5	26.2	25.5	25.0	20.0
Belgium:					
Primary	96.3	89.6	84.3	64.0	63.0
Secondary	37.8	38.1	30.0	26.0	26.0
Total	134.1	127.7	114.3	90.0	89.0
Brazil:					
Primary	¹ 20.6	26.0	29.8	32.7	² 28.8
Secondary	¹ 28.9	¹ 45.7	51.8	38.9	² 45.4
Total	¹ 49.5	¹ 71.7	81.6	71.6	74.2
Bulgaria: ^a					
Primary	98.6	98.6	98.0	97.0	98.0
Secondary	17.4	17.4	18.0	17.0	17.0
Total	116.0	116.0	116.0	114.0	115.0
Burma: Primary	7.6	7.0	9.6	5.4	² 4.0
Canada:					
Primary	¹ 178.0	173.0	173.2	169.9	² 139.5
Secondary	63.9	79.0	68.4	87.7	² 86.3
Total	¹ 241.9	252.0	241.6	257.6	² 225.8
China: ^a					
Primary	165.0	165.0	¹ 170.0	¹ 200.0	200.0
Secondary	30.0	30.0	¹ 40.0	¹ 40.0	40.0
Total	195.0	195.0	¹ 210.0	¹ 240.0	240.0
Colombia: Secondary ^a	3.0	3.0	3.0	4.0	4.0
Cyprus: Secondary ^a	2.5	2.5	2.0	2.0	2.0
Czechoslovakia: Secondary	21.0	21.1	21.4	23.6	20.0
Denmark: Secondary	10.0	13.0	4.5	.6	—
Finland: Secondary	6.0	4.5	4.4	1.2	1.2
France:					
Primary	115.0	117.9	133.6	132.0	² 115.6
Secondary	99.4	88.8	90.0	98.4	² 97.2
Total	214.4	206.7	223.6	230.4	212.8
German Democratic Republic: Secondary ^a	36.0	35.0	55.0	¹ 40.0	45.0
Germany, Federal Republic of:					
Primary	217.0	191.9	181.0	182.1	160.7
Secondary	135.5	165.3	175.3	184.5	182.3
Total	352.5	357.2	356.3	366.6	343.0

See footnotes at end of table.

Table 27.—Lead: World refinery production, by country¹—Continued

(Thousand metric tons)

Country	1983	1984	1985	1986 ²	1987 ³
Greece: Primary			15.0	16.0	16.0
Guatemala: Secondary	1	1	1	1	2.1
Hungary: Secondary ⁴	1	1	1	1	1
India					
Primary	15.0	15.2	15.6	19.9	² 20.4
Secondary	6.6	² 10.0	² 10.0	11.3	² 12.0
Total	21.6	² 25.2	25.6	31.2	² 32.4
Ireland: Secondary	8.0	9.1	9.0	10.2	10.4
Italy					
Primary	37.0	37.6	29.5	29.3	66.0
Secondary	89.4	102.9	96.7	101.7	94.0
Total	126.4	140.5	126.2	131.0	160.0
Jamaica: Secondary ⁵	1.0	1.0	1.0	1.0	1.0
Japan					
Primary	203.3	233.8	233.7	232.7	² 218.8
Secondary	118.3	129.2	133.3	128.7	² 119.5
Total	321.6	363.0	367.0	361.4	² 338.3
Korea, North: Primary ⁶	60.0	95.0	95.0	95.0	95.0
Korea, Republic of ⁷					
Primary	⁷ 7.6	⁷ 11.4	⁷ 11.0	⁷ 32.1	32.4
Secondary	⁷ 10.2	⁷ 8.9	⁷ 9.2	⁷ 27.5	27.6
Total	17.8	20.3	⁷ 20.2	⁷ 59.6	60.0
Malaysia: Secondary	5.3	10.3	14.6	13.8	14.0
Mexico					
Primary	162.5	163.2	193.5	178.9	175.8
Secondary ⁸	31.0	39.0	31.0	⁷ 31.6	33.0
Total ⁹	193.5	193.2	224.5	⁷ 211.9	208.8
Morocco					
Primary	55.2	46.1	59.5	60.0	62.5
Secondary ¹⁰	2.0	2.0	2.0	2.0	2.0
Total ¹¹	57.2	48.1	61.5	62.0	64.5
Namibia: Primary	35.4	28.9	38.0	40.0	40.0
Netherlands					
Primary	2.0				
Secondary ¹²	² 23.6	² 25.0	25.0	25.0	30.0
Total ¹³	² 25.6	² 25.0	25.0	25.0	30.0
New Zealand: Secondary ¹⁴	6.0	6.0	6.0	6.0	6.0
Nigeria: Secondary ¹⁵	2.0	2.0	3.0	3.5	3.5
Pakistan: Secondary ¹⁶	1.0	1.0	1.0	1.0	1.0
Peru					
Primary	67.7	70.2	81.8	66.4	66.4
Secondary ¹⁷	5.0	5.0	5.0	5.0	5.0
Total ¹⁸	72.7	75.2	86.8	⁷ 71.4	71.4
Philippines: Secondary	6.0	4.0	7.0	7.0	7.0
Poland					
Primary ¹⁹	⁹ 66.5	58.4	61.1	⁶ 63.3	60.0
Secondary ²⁰	² 24.5	25.0	26.2	² 25.0	25.0
Total	81.0	83.4	87.3	⁶ 88.3	85.0
Portugal: Secondary	6.0	6.0	7.0	⁶ 6.5	6.5
Romania					
Primary ²¹	40.0	35.9	38.6	36.0	35.0
Secondary ²²	9.3	10.0	10.0	⁵ 15.5	10.0
Total	49.3	45.9	48.6	51.5	45.0
South Africa, Republic of: Secondary	23.6	30.8	32.8	40.5	41.0

See footnotes at end of table.

Table 27.—Lead: World refinery production, by country¹—Continued

(Thousand metric tons)

Country	1983	1984	1985	1986 ^b	1987 ^c
Spain:					
Primary	107.8	110.1	112.8	88.0	77.0
Secondary	36.0	49.9	43.3	42.0	40.0
Total	143.8	160.0	156.1	130.0	117.0
Sweden:					
Primary	34.8	49.8	43.2	50.0	50.0
Secondary	15.2	27.7	25.9	29.8	30.0
Total	50.0	77.5	69.1	79.8	80.0
Switzerland: Secondary	2.0	2.0	2.0	2.5	2.4
Taiwan: Secondary ^d	38.0	44.3	44.4	^e 53.5	54.0
Thailand: Secondary	3.2	6.2	7.5	9.1	10.0
Trinidad and Tobago: Secondary ^e	2.0	2.0	2.0	2.0	1.8
Tunisia:					
Primary	10.4	8.4	2.0	2.2	2.2
Secondary ^e	.5	.5	.5	.5	.5
Total ^e	10.9	8.9	2.5	^e 2.7	2.7
Turkey ^e :					
Primary	2.0				
Secondary	5.5	9.0	10.0	10.0	10.0
Total	7.5	9.0	10.0	10.0	10.0
U.S.S.R. ^e :					
Primary	490.0	495.0	500.0	500.0	505.0
Secondary	255.0	260.0	265.0	270.0	275.0
Total	745.0	755.0	765.0	770.0	780.0
United Kingdom:					
Primary	136.9	147.1	148.1	156.1	² 137.5
Secondary	185.3	191.3	179.1	172.5	² 200.7
Total	322.2	338.4	327.2	328.6	338.2
United States:					
Primary	^e 519.2	^e 389.4	494.0	370.3	373.6
Secondary	503.5	633.4	615.7	624.8	710.2
Total	^e 1,022.7	^e 1,022.8	1,109.7	995.1	1,083.8
Venezuela: Secondary ^e	15.0	17.0	18.0	16.0	17.0
Yugoslavia:					
Primary	^e 85.0	^e 62.6	83.0	116.5	101.0
Secondary	^e 38.0	37.4	40.0	38.5	41.0
Total	^e 123.0	^e 100.0	123.0	155.0	142.0
Zambia: Primary	14.6	8.8	8.9	6.6	6.0
Grand total	^e 5,288.6	^e 5,456.2	5,661.4	5,583.2	5,629.8
Of which:					
Primary	^e 3,264.6	^e 3,161.1	3,369.6	3,229.0	3,176.6
Secondary	^e 2,024.0	^e 2,295.1	2,291.8	2,354.2	2,453.2

^eEstimated. ^bPreliminary. ^cRevised.¹Table includes data available through June 24, 1988. Data included represent the total output of refined lead by each country, whether derived from ores and concentrates (primary) or scrap (secondary), and include the lead content of antimonial lead, but exclude, to the extent possible, simple remelting of scrap.²Reported figure.